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**ABSTRACT**

Findings of two studies which examined the identification of prekindergarteners with potential learning problems are presented. The first was a pilot study, in which a short screening device and a parent questionnaire were administered to a large, randomly-selected sample. In the second study, these instruments were validated against extensive diagnostic testing on a smaller sample selected to highlight children with high and low potential for school learning problems. The results indicated that (1) the screening device identified the learning disabled children, as defined by the diagnostic testing, with over 90% accuracy, (2) teacher ratings of the children were inaccurate as compared to the results of the testing, and (3) the parents were not a reliable source of information about their children. Recommendations are made for the evaluation of five different intervention models to determine which types of learning deficits are amenable to remediation. (Author/HV)

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Early Assessment and Remediation of School Learning  
Problems in a Large Urban Setting: A Realistic Approach

The Chicago EARLY Project

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Department of Research and Evaluation

Paper presented at the annual meeting of the American Educational  
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## Abstract

This report presents the findings of two studies which examined the problem of identifying prekindergarteners with potential learning problems. The first study was a pilot study, in which a short screening device and a parent questionnaire were administered to a large, randomly-selected sample. In the second study, these instruments were validated against extensive diagnostic testing on a smaller sample selected to highlight children with high potential for school learning problems and children with low potential for such problems. The results indicate that (1) the screening device identified the "learning disabled" children, as defined by the diagnostic tests, with over 90% accuracy; (2) teacher ratings of the children were inaccurate as compared to the results of the testing, and (3) the parents were not a reliable source of information about their children. Recommendations are made for the evaluation of five different intervention models to determine which types of learning deficits are amenable to remediation.

## Overview

The goal of this research is to determine the feasibility of identifying and remediating pre-kindergarten children who may have learning problems in later school years. The project seeks the answers to a pair of related but sequential questions: (1) can children with potential learning problems be identified fairly accurately at 42 months of age, and (2) if such children can be identified with acceptable precision, is it possible to ameliorate the projected deficit prior to or concurrent with the children's entrance into the primary grades? The answers to these questions are interdependent, for it is useless to diagnose problems which cannot be ameliorated, and it is futile to remediate problems which do not predict later school problems. Four major components were identified as necessary for the realization of the goals: research, screening, diagnosis, and remediation. To date, the research, screening, and diagnostic phases are complete.

The focus of the research is the type of learning problem known as "learning disabilities." The accepted definition of this disorder, formulated by the National Advisory Committee on Handicapped Children in 1968, is as follows:

Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written languages. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic... They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage. (p. 4)

Children with this type of disorder are much more difficult to identify at an early age than are children with more severe or obvious handicaps, such as mentally retarded, deaf, or crippled children. The latter types of exceptionalities are usually spotted by parents or pediatricians while the child is quite young. Learning disabilities, on the other hand, are usually not identified until the child is well into his school years, and has already

experienced the feelings of frustration and inadequacy associated with failure.

### Research

Previous research aimed at these questions are of two types: (1) studies attempting to identify characteristics of young children which predict school success or failure, and (2) studies attempting to evaluate the effects of intervention programs. Unfortunately, the areas of prediction and intervention have developed independently, without the coordination which could be mutually beneficial. The prediction studies (e.g., Stevenson et al., 1976) have been concerned with establishing relationships between early childhood variables and later outcomes without a consideration of using such data for purposes of prevention. On the other hand, intervention programs (e.g., Karnes, 1973) have been developed from a more or less intuitive notion of what will predict school failure, rather than on an empirical basis. Although such an approach may result in ameliorating some or all of the attributes which actually are predictive of school failure, it is certainly a costly and inefficient approach to the problem.

A few recently reported studies have dealt with both prediction and prevention, but the earliest age examined is that of kindergarten level. Silver and Hagin (see Yahraes and Prestwich, 1976), for example, report the results of a screening battery which is designed to predict at the end of kindergarten which children will likely have learning problems. In the same publication is a report of the work of Paul Satz, who has developed predictive measures to be administered early in kindergarten. Unfortunately, Satz developed his measures on a sample limited largely to white boys, which certainly reduces the utility of the data for a city such as Chicago.

Furthermore, child development experts such as Burton White (1973) are expressing the view that to identify 5-6 year olds with problems may be too late for effective remediation. The present trend in research is to provide intervention for disadvantaged children at as early an age as possible. Of course, the younger a child is when tested, the less reliable or predictive are the results (Bayley, 1970). The age of  $3\frac{1}{2}$ - $4\frac{1}{2}$  was chosen for this study because the children will already have had some experience with language and symbols, without having been placed yet in a potentially stressful learning environment.

#### A Model for Identification of Prekindergarten Children

To attack the problem of prediction and intervention for prekindergarteners, one must analyze the basic skills that are precursors to reading and writing. The school-related tasks assume visual perceptual abilities (e.g., recognizing likenesses and differences in complicated forms), auditory skills (e.g., the ability to discriminate among sounds), and a well-developed memory (for both visual and auditory features). Furthermore, a child must possess certain motor abilities for communication on paper and language skills for communication verbally. The goal of identifying pre-reading children who will have problems reading, and pre-writing children who will have problems writing, challenges the researcher to operationalize the skills at a more primitive level than that used in school.

To simplify this task, the information-processing model in Figure 1 was developed. Three levels of information processing were selected as relevant to the skills in question: encoding (auditory or visual), decoding (rote or conceptual), and response (motor or verbal). Relying on the model throughout all stages of the study allows for the identification of those combinations of levels of processing in which deficits can be reliably pinpointed and stably remediated, as well as the identification of those combinations which are either not able to be accurately identified or not responsive to remediation.

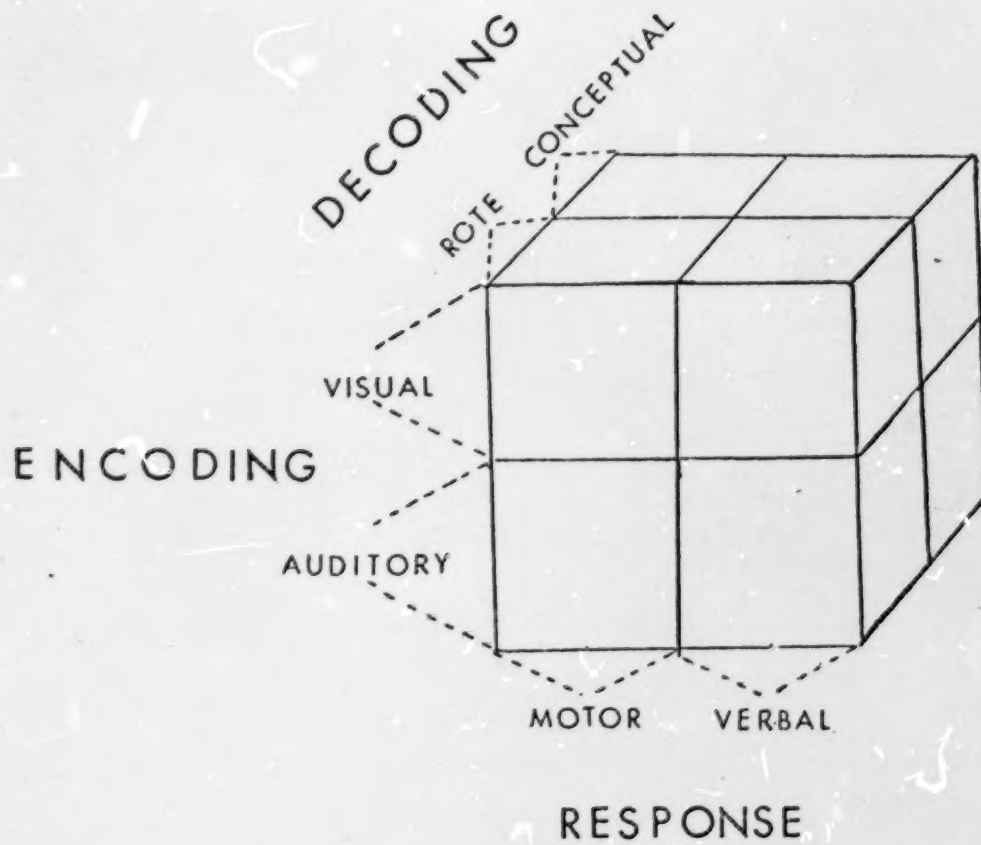


Figure 1. Information Processing Model for Identification of Children with Potential Learning Problems

### Screening - Pilot Study

A device was developed to screen out the approximately 80% of the 3½ - 4½ year old children not likely to have later school problems. The behaviors chosen for the screening device are presented in Table 1. Six sources led to the selection of the items:

- 1) the potentially predictive elements set out in the model;
- 2) characteristics of school-age learning disabled children (see Lerner, 1971);
- 3) developmental milestones expected to be passed by the average child of this age (Goldman & Martin, 1971);
- 4) the results of longitudinal research aimed at prediction questions (e.g., White, 1973);
- 5) the framework of already existing preschool screening and diagnostic devices (e.g., the Denver Developmental screening Test by Frankenburg et al., 1967); and
- 6) the results of a pilot study conducted in Chicago to determine the most appropriate level of difficulty of items for youngsters in Chicago.

The instrument is characterized by an administration time of 15-20 minutes and a procedure easily administered by paraprofessionals.

Table 1

## Items on the Screening Device\*

## I. Gross Motor Tasks

1. Walking on tiptoe (2)
2. Walking on a 3' line (2)
3. Standing on one foot and hopping (2)
4. Throwing and catching a bean bag (2)

## II. Fine Motor and Visual Perception Tasks

1. Copying a circle and cross (3)
2. Drawing a line in between parallel lines (3)
3. Building a "bridge" with blocks (3)
4. Matching symbols (1)
5. Completing puzzles of 2, 3, and 4 pieces (3)

## III. Cognition Tasks

## A. Memory

1. Following 2-step directions (1 & 3)
2. Recalling unrelated words (1)
3. Remembering the serial order of pictures (1)

## B. Concepts

1. Number
  - a. Demonstrating the concept of "1," "2" and "3" (1 & 3)
  - b. Counting (4)
2. Identifying color (4)
3. Identifying "big" and "little" (1)
4. Sorting blocks by shape (3)
5. Identifying body parts (1)

## IV. Language

## A. Receptive

1. Identifying objects in pictures (1)
2. Recognizing action in pictures (1)
3. Recognizing function of objects in pictures (1)
4. Demonstrating the use of prepositions - "under" and "on" (1)

## B. Expressive

1. Naming objects in pictures (1)
2. Answering questions - "What do you do when you're sleepy/hungry?" (1)
3. Speaking - how easily the child's speech is understood (1)

\*Note: The number of the factor for each item is in parentheses.

Sample. The screening device was administered to 836 normal preschool-age children living in District 7 in Chicago. This district was chosen for the sample because it is the most representative of the city in terms of ethnic make-up and poverty level. The sample included children who were enrolled in all types of preschool programs, both public and private, and children who were not attending any type of preschool. Of the 836 children tested, 87.1% were tested at their school and 12.9% were tested at the Center for Urban Education. The sample consisted of 428 males and 408 females. The children ranged in age from 30-65 months old, with 97.2% of the children in the age range of 36-55 months old. Of the 820 children identified as to ethnic background, 36.8% were white, 45.9% black, 11.6% Hispanic, and 5.7% other.

Clusters of responses on the screening device. A factor analysis of the screening device indicated four basic factors underlying the tested behaviors. The first factor is a combination of concepts, memory, and language. It includes all the language items, both receptive and expressive, and all the cognition items except for counting, identifying color, and sorting blocks by shape. It also includes matching symbols. The second factor consists of all the gross motor tasks, and no other items. The third factor seems to represent visual perception and fine motor behavior, including copying designs, building a "bridge," drawing a line between parallel lines, completing puzzles, and sorting by shape. The fourth factor includes only the two items of counting and identifying color, which are both experientially-based and largely learned on a rote basis. The items of following directions and demonstrating number concepts both load as heavily on the first as on the third factor.

Another approach to the interpretation of the identified factors is to utilize the information-processing model mentioned earlier. For the encoding level, a classification of abstract vs. concrete seems to be more useful than auditory vs. visual. In this case, abstract covers both auditory and pictorial presentation of material, while concrete refers to the presentation of manipulable objects. The decoding level may be specifically defined as rote information as opposed to a generalization of previously learned knowledge to new stimuli. The response level breaks down to fine motor, gross motor, and verbal.

Except for the items of following directions, demonstrating number, and demonstrating prepositions, all of Factor 1 items involve abstract input of information. The three exceptions combine verbal instructions with concrete materials, and unlike the items in Factor 3, the child must listen carefully in order to understand what to do with the objects. Factor 3, on the other hand, includes only items which provide concrete input with minimal instruction necessary for comprehension of the task. All of the Factor 3 items require a fine motor response; some Factor 1 items require a fine motor response (pointing) while others require a verbal response. Factor 2 consists of all gross motor tasks in which the child uses his or her body for demonstrating the response. The input may be considered concrete, since the tester demonstrates each item for the child. Factor 4 is defined at the level of decoding: rote as opposed to requiring generalization. Thus, the crucial aspect of Factor 1 is abstract input, of Factor 2 is gross motor response, of Factor 3 is concrete input-fine motor response, and of Factor 4 is rote decoding.

### Parent Questionnaire

A questionnaire was developed concurrently with the screening device to investigate the value of parents' input in the screening process. The items were selected to provide supplementary family background information, supplementary information about the child's social-emotional development, and information parallel to data obtained on the screening device for reliability purposes.

The parent questionnaire was completed for 390 (46.7%) of the children tested. The data indicated that 38% of these children were from single-parent homes. Of the adults listed, 43% had white collar jobs, 18% had blue collar jobs, and 39% did not work. In terms of income level, 33.6% of the families had a total income of less than \$6000, 27.4% had an income between \$6000 and \$12000, and 39.1% had a total income of greater than \$12000.

Clusters of responses on the parent questionnaire. A factor analysis on the parent questionnaire revealed several more, less clearcut, factors than on the screening device. The items which fall into the ten factors are listed in Table 2. Factors 5, 6, 7, and 9 are the easiest to interpret. Factor 5 seems to involve concentration -- perhaps children with greater attention spans like to play with blocks and puzzles, or perhaps playing with blocks and puzzles increases a child's attention span. Factor 6 involves informational (rote) learning. Factor 7 may be dealing with the quality of independence. Factor 9 consists of items dealing with verbal ability.

Correlations among items. Some of the items on the questionnaire were written to ask for the same information in different ways (as a type of inner reliability measure). One such pair of items -- "Do you usually say things more than once..." and "Do you usually repeat instructions..." -- correlated .31 with each other. A second pair of similar questions (the two in Factor 9) correlated .25 with each other. A third set of questions, written to identify a child's inability to communicate effectively ("Do adults often

Table 2

## Factors of the Parent Questionnaire

Factor 1.

1. Does your child often drop or spill food when eating?
2. Do you usually say things more than once before your child understands?
3. When your child wants something, does he or she usually act out what is wanted by pointing, pulling, or crying?
4. Do adults often ask your child to repeat what he or she is saying to them?
5. The TV at home is on: (negative loading)
  - a. less than 3 hours a day
  - b. 3-6 hours a day
  - c. 6-8 hours a day
  - d. more than 8 hours a day

Factor 2.

1. Does your child remember places where he has been before?
2. Is it hard for your child to throw, catch, or kick a ball? (negative loading)
3. Does your child open doors without help?

Factor 3.

1. Does your child give up quickly if things are not going his way? (negative loading)
2. Can your child cut paper with a pair of scissors?
3. Does your child usually wash his/her hands without help?

Factor 4.

1. My child has temper tantrums:
  - a. almost every day
  - b. once or twice a week
  - c. once or twice a month
  - d. rarely
  - e. never
2. Do you usually repeat instructions to your child two or more times before he or she does what is asked?

Factor 5.

1. When my child is interested in something, he or she will sit still and pay attention for: (negative loading)
  - a. less than 5 minutes
  - b. 5-15 minutes
  - c. 15-30 minutes
  - d. 30-60 minutes
  - e. more than 1 hour

Table 2  
Continued

Factor 5. - Continued

2. Does your child play with blocks?
3. Does your child play with puzzles?

Factor 6.

1. Can your child tell you the color of things?
2. Does your child know the meaning of "big" and "little?"

Factor 7.

1. Do you usually help your child button his/her coat? (negative loading)
2. Does your child usually play by himself?

Factor 8.

1. How often do you take your child shopping with you?
2. Do you think your child may have difficulty learning in elementary school? (negative loading)

Factor 9.

1. Does your child ask a lot of questions?
2. Does your child tell stories about events which happen to him/her?

Factor 10.

1. Do you usually eat one or more meals a day with your child?
2. Does your child trip or fall often?

NOTE: Factors 6-10 contribute very little to the variance, but are included to provide a listing of the items.

ask your child to repeat what he/she is saying to them?" and "When your child wants something, does he or she usually act out what is wanted...?") correlated .30 with each other. These correlations are not extremely high, but they are significant at the .001 level.

Parallel items on screening device and parent questionnaire. Several items were included on the parent questionnaire to parallel items on the screening device. The pair which correlated the highest was whether or not the child knows his/her colors ( $r=.48$ ). Of all of the questions, parents are probably least sensitive about giving a negative answer to this one, which is more or less factual. The items aimed at the child's experience with puzzles correlated .11; those aimed at the child's concept of size correlated .12; those measuring the child's ability to articulate effectively correlated .18; those aimed at the child's ability to throw and catch a ball correlated .105; those aimed at the child's memory correlated .19; and those questioning the child's balance correlated .05. All of these (except the one for "colors") are too low to be meaningful.

In general, the preliminary analyses of the parent questionnaire suggested that it is not an effective substitute for a screening device, which requires the child to perform certain tasks for a trained observer. This conclusion was based partly on the low correlations obtained between similar items on the questionnaire and partly on the low correlations obtained between parallel items on the two instruments. The latter can be used as evidence only if we assume that the inconsistency of the two measures stems from the unreliability of the parents' responses, rather than from the screening device. More information about this issue was obtained from the validation study which followed the pilot study.

### Diagnostic-Validation Study

Two diagnostic assessments were developed for validating the screening device in terms of its identification of children who should be examined more closely. They were designed not only to determine whether a problem actually existed, but also to pinpoint each child's particular deficit area. There were two test batteries developed in order to determine the best combination of subtests for diagnosis, and to obtain reliability data from pairs of subtests which tested the same skill with different test items. Both assessments were based on the same potentially predictive factors used for the screening device. The subtests chosen for these two levels of diagnosis, called the diagnostic and the comprehensive, are listed in Table 3. All the tests were in both English and Spanish.

Sample. A total of 146 children were initially selected from eight pre-kindergarten programs in various locations of Chicago. Half of these children were rated by their teachers as having potential school learning problems. The other half of the sample were rated as not likely to have school learning problems, and were matched to the target children within each school by age and by sex. Several children moved away or were absent during the entire testing period and were subsequently dropped from the sample. The final sample consisted of 139 children, 121 of which received all three levels of testing, 10 of which were given the screening battery and the first diagnostic assessment, and 8 of which were given only the screening device. The incomplete testing was due to children being frequently absent or dropping out of school.

Of the 139 children, 72 were boys and 67 were girls. In terms of ethnic background, 23.7% were white, 66.2% were black, 4.3% were Hispanic, and 5.8% were of some other background. The children ranged in age from 44 months to 68 months, with 97% of the sample between 44 and 61 months. In terms of socio-economic status, the parents of 34.7% of the children earned less than

Table 3

Subtests of the Diagnostic Battery  
and of the Comprehensive Evaluation

## Classified by Type of Encoding and Response

|                      | Diagnostic                                             |                                                                 | Comprehensive                                               |                                                                          |
|----------------------|--------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------|
|                      | Motor Response                                         | Verbal Response                                                 | Motor Response                                              | Verbal Response                                                          |
| Visual<br>Encoding   | Leiter International Performance Scale                 | Visual Memory (s.d.t.)                                          | McCarthy Scales (designs, leg coordination blocks, puzzles) | Visual Memory (s.d.t.)                                                   |
|                      | Visual Memory (s.d.t.)                                 | Word Production (s.d.t.)                                        | Visual Memory (s.d.t.)                                      | Classification (s.d.t.)                                                  |
|                      | Visual-Motor Integration Test                          | Math (s.d.t.)                                                   | ITPA (visual closure, visual reception, visual association) | WPPSI (Math)                                                             |
|                      | Del Rio Language Screening Test (receptive vocabulary) |                                                                 | Visual Discrimination (s.d.t.)                              | Fisher-Logemann Test of Articulation                                     |
|                      | Gross Motor (s.d.t.)                                   |                                                                 | Classification (s.d.t.)                                     | Word Production (s.d.t.)                                                 |
|                      | Figure-ground test (s.d.t.)                            |                                                                 | Coding (s.d.t.)                                             |                                                                          |
|                      | Coding (WPPSI Animal House)                            |                                                                 |                                                             |                                                                          |
| Auditory<br>Encoding | Del Rio Language Screening (oral commands)             | ITPA (Auditory memory for digits)                               | McCarthy Scales (arm coordination)                          | Detroit Tests of Learning Aptitude (auditory memory for unrelated words) |
|                      | Math (s.d.t.)                                          | Del Rio (Auditory memory for sentences and story comprehension) | Test for Auditory Comprehension of Language                 | Carrow Elicited Language Inventory                                       |
|                      |                                                        |                                                                 | Boehm (following directions)                                | WPPSI (Math)                                                             |
|                      |                                                        |                                                                 | Math (s.d.t.)                                               |                                                                          |

Note: (s.d.t.) = staff developed test

\$6000, 35.5% earned between \$6000-\$12000, and 29.8% earned above \$12000. Furthermore, 42% of the children were from single-parent households. The teachers rated 69 of the children as not likely to have school learning problems, 20 as having an auditory problem, 12 as having a verbal problem, 2 as having a motor problem, 18 as having a social-emotional problem, and 18 as having a combination of problems. When the parents were asked if they thought their child might have a problem learning in school, only the parents of 11 children (8%) gave an affirmative answer.

Testing Staff. The screening device was administered by one of the trained paraprofessionals who had been involved in the piloting of the screening device. She was also certified by the State of Illinois as an audiometric technician, and administered the hearing screening to all the children in the sample. Vision screening was administered by trained technicians provided by the Vision Program of the Board of Education. The staff who conducted the two levels of diagnostic testing consisted of five professionals: a learning disabilities specialist, a speech and language specialist, an early childhood education specialist, a specialist in counseling, and a specialist in cognitive development and research techniques. Four had at least a Master's degree; one had a doctorate. The staff was racially mixed, and two of the testers were bilingual in English and Spanish, with one of them being bilingual/bicultural. All the testers were female.

Procedure. Each child was first given the screening device, then the diagnostic assessment, and then the comprehensive evaluation. No tester administered more than one level of testing to any child, and the testers refrained from discussing a specific child until all the testing with that child was complete. Due to time restrictions, the number of days between the administration of each level of testing could not be controlled. The number

of days between the administration of the screening and the diagnostic assessments ranged from 0-57, with 75% of the diagnostic tests given within 17 days of the screening. The number of days between the administration of the diagnostic and the comprehensive assessments ranged from 1-51, with 75% of the comprehensive evaluations given within nine days of the diagnostic.

An effort was made to give the diagnostic and the comprehensive assessments in one session each (averaging about 1-1½ hours for the diagnostic and 1½-2 hours for the comprehensive), but this was not always possible, sometimes because of the schools' schedules, and sometimes because of the children's attention span. On the diagnostic battery, 112 children were completed in one day, 16 children were tested on two different days, and three children were given the diagnostic on three different days. On the comprehensive evaluation, 62 of the children were completed in one day, 38 children were tested on two days, 13 were tested over three days, five were tested over four days, one was tested over five days, and one was tested over six days.

The staff also attempted to limit the number of testers who shared the administration of each battery of tests on a child, to maximize the rapport built up between tester and child. Again, it was not always possible for one tester to give all the subtests of a battery to a child. On the diagnostic assessment, 106 children were completed by one tester alone, 22 children were tested by two testers, and three children were tested by three testers. On the comprehensive assessment, 82 children were completed by one tester, 35 children were tested by two testers, and three children were tested by three testers.

Behavior Checklist. Every time a tester worked with a child, she filled out a behavior checklist for that child for the session. The behaviors which were noted included excessive movement, being easily distracted, impulsivity, perseveration, rigidity, and being exceptionally shy or withdrawn.

Clusters of subtests. A factor analysis was conducted on all the diagnostic measures to determine the relationships among the variables. The factors are listed in Table 4. All the items in the first factor involve visual encoding and motor response except for three items. The three exceptions are the Del Rio Story Comprehension, the WPPSI Auditory Arithmetic, and the Word Production of the comprehensive. The first two involve auditory input and verbal response; the third has visual input with verbal response. The former two items are the only ones of all the measures which are auditory - verbal and conceptual rather than rote in nature. Why the Word Production II falls in this factor while Word Production I is in Factor 2 is difficult to explain. The correlation between the two Word Production subtests was rather high at .569, but the distribution of scores indicated that Word Production II was somewhat easier for the children (perhaps due to a practice effect or to easier items). Overall, Factor 1 probably represents more of a general intelligence factor than anything else.

All the items in Factor 2 involve auditory input and verbal response at a rote level of processing, with two exceptions. The Del Rio Following Directions is auditory input - motor response, and the Word Production I is visual input - verbal response. However all the items have a strong memory component which may be what ties these variables together.

Table 4

FACTORS OF THE DIAGNOSTIC MEASURESFactor 1. (52.5%)

Del Rio Receptive Vocabulary  
 Del Rio Story Comprehension  
 Leiter colors  
 Leiter numbers  
 Leiter Block design  
 VMI  
 Carrow vocab.  
 Carrow morphology  
 Carrow syntax  
 ITPA Visual Association  
 McCarthy Block building  
 Word Production II  
 Visual Discrimination  
 WPPSI Auditory Arithmetic  
 McCarthy Puzzles  
 McCarthy Draw-a-design  
 Coding I  
 Coding II

Factor 2. (7.7%)

Del Rio Sentence Repetition-length  
 Del Rio Sentence Repetition-complexity  
 Del Rio Following Directions  
 Word Production I  
 Auditory Memory for digits  
 Carrow Elicited Language Inventory  
 Auditory Memory for words

Factor 3. (5.2%)

Classification - shape  
 Classification - size  
 Classification - color

Factor 4. (4.7%)

Motor behavior  
 Noisy behavior  
 Impulsive behavior  
 Distractible behavior

Factor 5. (3.8%)

Leiter shapes  
 Leiter visual discrimination  
 Seriation

Factor 6. (3.7%)

Following Directions II  
 Visual Memory II  
 Uncooperative behavior (negative)  
 Tired -seeming behavior (negative)

Factor 7. (3.4%)

Behavior seeking approval  
 Shy & withdrawn behavior

Factor 8. (3.0%)

One-to-one correspondence  
 ITPA Visual closure

Factor 9. (2.9%)

ITPA Visual Reception

Factor 10. (2.6%)

Leiter Association  
 Vision

Factor 11. (2.5%)

Gross Motor I  
 McCarthy leg coordination  
 McCarthy arm coordination

Factor 12. (3.0%)

Leiter Pattern Completion

Factor 13. (2.2%)

Number Recognition  
 Naming shapes

Factor 14. (1.9%)

Visual Memory I  
 WPPSI Picture Arithmetic  
 Polar opposites

Factor 15. (1.7%)

Articulation

Notes: (1) I refers to the diagnostic battery; II refers to the comprehensive.  
 (2) The amount of variance accounted for by each factor is in parentheses.

Factor 3 consists only of the three classification tasks used in the comprehensive evaluation. Factor 4 represents all the observable behavior which might be termed "hyperactivity." Factor 5 variables deal with the recognition of details of shape and size. Factor 6 includes two items with a memory component and two observable behaviors which would make remembering difficult (the two behaviors loaded negatively on the factor). The two items in Factor 7 are behaviors which indicate uncertainty. Factor 8 represents visual input-motor response with conceptual processing. The only item in Factor 9 is the ITPA Visual Reception, which did not correlate above .38 with any variable of the diagnostic measures except the ITPA Visual Association ( $r = .50$ ). Factor 11 consists of the three gross motor items.

#### Relationship between screening and diagnostic measures.

The screening device, parent questionnaire, and two diagnostic assessments included many items which were chosen to measure the same abilities. The correlations between similar items on the screening device, the diagnostic battery, and the comprehensive evaluation are in Table 5. Generally, the correlations between the items on the screening and the other two assessments are lower than those between the two diagnostic assessments. This is to be expected, since the items on the screening device were much shorter and less comprehensive than the parallel items on the diagnostic assessments. Overall, the correlations are strong enough to indicate that the parallel items on the three assessments were measuring the same skills.

#### Relationship between parent questionnaire and other assessments.

The parent questionnaire contained some items which were directed at the same skills tested on the other assessments. The correlations between the parallel items on the different instruments are presented in Table 6. Generally, the correlations are lower between the parent questionnaire and the other assessments as compared to the inter-correlations of the other

Table 5

Correlations between Items on the Screening Device  
and the Diagnostic Measures

| Item                        | Screening<br>and<br>Diagnostic | Screening<br>and<br>Comprehensive | Diagnostic<br>and<br>Comprehensive |
|-----------------------------|--------------------------------|-----------------------------------|------------------------------------|
| Drawing Designs             | .37                            | .35                               | .75                                |
| Block-Building              | -                              | .22*                              | -                                  |
| Gross Motor                 | .42                            | .29                               | .62                                |
| Puzzles                     | -                              | .66                               | -                                  |
| Counting                    | .35                            | .36                               | .48                                |
| Following directions        | .27                            | .17**                             | .50                                |
| Visual discrimination       | .31                            | .41                               | .31                                |
| Memory for words/<br>digits | .41                            | .24*                              | .66                                |
| Memory for sentences        | -                              | -                                 | .68                                |
| Shape concept               | .29                            | .31                               | .34                                |
| Size concept                | .27                            | .23*                              | .01+                               |
| Color concept               | .29                            | .23*                              | .26*                               |
| Receptive vocabulary        | .34                            | .53                               | .62                                |
| Expressive vocabulary       | .38                            | .31                               | .57                                |
| Articulation                | -                              | .38                               | -                                  |
| Visual memory               | .27                            | .30                               | .45                                |

\* $p < .01$ \*\*  $p < .05$ + $p > .05$ Note: Unless otherwise marked,  $p < .001$ .

assessments. This is not too surprising, since the method of obtaining the information was indirect in the parent questionnaire but directly observable from the children's behavior on the other assessments. However, some of the correlations (e.g., the one for the item of receptive language ability) indicate a measure of reliability for the parent questionnaire. This is useful information for future modification of the parent questionnaire, although overall this instrument does not appear to be reliable enough to be used independently.

#### Comparison of Measures in Pilot Study and Validation Study

Screening device. In the pilot study, the screening device was administered to a large, randomly-selected sample of children. The performance of this sample could easily be generalized to that of a normal population. In contrast, the smaller sample of children in the validation study was carefully selected in order to increase the number of children to be identified as having potential school learning problems. This procedure makes possible an examination of the behavior of the instrument in two settings.

Table 7 presents the means and standard deviations of the variables on the screening device in both the pilot and the validation studies. The means are surprisingly similar, considering the differences in the samples tested. The standard deviations are consistently larger in the validation study, which reflects the fact that the sample consisted of children who represented the two extremes of ability, while the pilot study sample consisted of children representing the normal population. No statistical measure of reliability was computed on these data, because the comparison of the statistics in Table 7 is alone a strong indicator of the reliability of the screening instrument in two settings.

Table 6  
Correlations between Items on the Parent Questionnaire  
and the other Assessments

| Item                 | Parent<br>Screening | Parent<br>&<br>Diagnostic | Parent<br>&<br>Comprehensive |
|----------------------|---------------------|---------------------------|------------------------------|
| Blocks               | .04                 | -                         | .06                          |
| Gross Motor          | .16                 | .06                       | .16                          |
| Puzzles              | .21*                | -                         | .23*                         |
| Following directions | .05                 | .41**                     | .23*                         |
| Size concept         | .25*                | .34**                     | .05                          |
| Color concept        | .44**               | .11                       | .17                          |
| Receptive language   | .38**               | .27**                     | .30**                        |
| Expressive language  | .20                 | .23*                      | .30**                        |
| Articulation         | .20                 | -                         | .26**                        |
| Visual memory        | .11                 | .19                       | .11                          |

\*  $p < .01$ \*\*  $p < .001$

A factor analysis was conducted on the variables of the screening device in the validation study to compare with the factor analysis of the same variables in the pilot study. The behavior of the variables did not differ to a great extent in the two studies. The first factor was essentially the same, being a combination of concepts, language, and memory. The second factor in the pilot study was gross motor items alone; in the validation study the second factor was a combination of gross motor and fine motor. This difference may have occurred because the gross motor tasks were combined as one score in the validation study whereas they were treated as separate variables in the pilot study. Thus, the second factor in the validation study was essentially a combination of Factors 2 and 3 of the pilot study. Factor 3 of the validation study was the same as Factor 4 of the pilot study, i.e., rotely-learned items.

There were only four items which were exceptions to the above comparison. The two items "answering questions" and "serial memory for pictures" were both on Factor 1 of the pilot study. However in the validation study, "answering questions" fell on Factor 2 and "serial memory" was the single item on Factor 4. Also, the two items "completing puzzles" and "sorting blocks by shape" were both on the third factor in the pilot study (i.e., fine motor response). In the validation study, however, the former item fell on Factor 1 and the latter item fell with the rotely-learned items.

Overall, the two factor analyses were quite similar. This information, taken in conjunction with the comparison of the statistics of the variables, presents strong support for the reliability of the screening device.

Table 7

Comparison of Means and Standard  
Deviations on the Screening Device in the  
Pilot Study and in the Validation Study

| Item                | Pilot Study |      | Validation Study |      |
|---------------------|-------------|------|------------------|------|
|                     | Mean        | S.D. | Mean             | S.D. |
| Gross Motor         | 12.45       | 2.85 | 12.48            | 3.60 |
| Copying             | 3.35        | 1.12 | 3.61             | .99  |
| Lines               | 2.28        | .86  | 2.42             | .94  |
| Blocks              | 2.75        | .64  | 2.65             | .76  |
| Symbols             | 6.17        | 1.56 | 6.14             | 1.78 |
| Puzzles             | 1.96        | 1.02 | 1.63             | 1.21 |
| Follow directions   | 3.12        | 1.27 | 3.22             | 1.25 |
| Memory-words        | 9.95        | 2.15 | 10.09            | 2.26 |
| Memory-pictures     | 3.38        | 1.13 | 2.34             | 1.31 |
| Number              | 2.45        | .77  | 2.45             | .78  |
| Counting            | 3.03        | 1.22 | 3.19             | 1.32 |
| Color               | 6.08        | 2.79 | 5.86             | 2.89 |
| Size                | 2.85        | .52  | 2.84             | .63  |
| Shape               | 2.59        | .82  | 2.58             | .87  |
| Body parts          | 4.51        | .97  | 4.41             | 1.20 |
| Recognize objects   | 5.26        | 1.24 | 5.27             | 1.49 |
| Recognize actions   | 4.43        | 1.08 | 4.41             | 1.28 |
| Recognize functions | 5.56        | 1.22 | 5.49             | 1.51 |
| Prepositions        | 1.62        | .65  | 1.71             | .56  |
| Naming Objects      | 6.37        | 1.26 | 6.30             | 1.66 |
| Answering Questions | 3.04        | 1.27 | 3.00             | 1.39 |
| Articulation        | 1.82        | .49  | 1.86             | .45  |

Parent questionnaire. Similar comparisons of the parent questionnaire in the two studies were conducted. The statistics of the items on this instrument were not as interesting, because many of the questions had a limited range of response (e.g., "yes" or "no"). Therefore, comparisons of the correlations between parallel items on the parent questionnaire and between the parent questionnaire and the screening device were conducted. These statistics are presented in Table 8. The largest difference between parallel correlations was on the item dealing with the concept of size, with  $r = .12$  on the pilot study and  $r = .25$  on the validation study. Once again, the items geared toward the concept of color produced the highest correlation. Generally, the correlations remained fairly low in the validation study and reinforce the notion that the parent questionnaire should not be relied upon as an independent source of information.

A factor analysis was also conducted on the parent questionnaire in the validation study to compare to that of the pilot study; however, these two factor analyses were not even comparable. The most interesting aspect is the question, "Do you think your child may have difficulty learning in elementary school?" This did not account for much variance in the pilot study, but was the first factor on the validation study. The other factors in the second study do not fall in an interpretable pattern and thus will not be reported.

The difference in factor analyses may stem from a difference in the attitude of the parents in the two studies. In the pilot study, the permission to test the children was given by the directors of the prekindergarten programs in many cases, and the parents were simply requested to fill out the questionnaire as an added source of information. In the validation study, on the other hand, the parents were required to complete the questionnaire if their child was to be tested. Furthermore, the parents in the validation study were told that the results of the testing would be available to the teachers, whereas

Table 8

Correlations between Parallel Items on the Parent  
Questionnaire and between the Parent Questionnaire  
and Screening Device in Two Studies

| Item                   | Comparison                 | Pilot<br>Study | Validation<br>Study |
|------------------------|----------------------------|----------------|---------------------|
| Following directions   | Within Parent Question.    | .31            | .36                 |
| Expressive language    | Within Parent Question.    | .25            | .18                 |
| Ability to communicate | Within Parent Question.    | .30            | .24                 |
| Color concept          | Between Parent & Screening | .48            | .44                 |
| Puzzles                | Between Parent & Screening | .11            | .21                 |
| Playing catch          | Between Parent & Screening | .10            | .07                 |
| Size concept           | Between Parent & Screening | .12            | .25                 |
| Articulation           | Between Parent & Screening | .18            | .20                 |
| Memory                 | Between Parent & Screening | .19            | .11                 |
| Balance                | Between Parent & Screening | .05            | .16                 |

this was not true in the pilot study. Thus, the parents in the validation study may have felt that their responses were important while those in the pilot study did not. Nevertheless, no matter what the actual reason for the difference in the behavior of the parent questionnaire in the two studies, the discrepancies indicate an unreliability in the instrument.

#### Prediction of School Learning Problems.

Procedure. Based on the several-hour diagnostic evaluation of each child, the professional staff was able to make decisions as to which children might have problems later in school and which children were likely not to have learning problems. These decisions were based on two types of evidence: (1) the mental age of the child, as defined by the score on the Leiter International Performance Scale, and (2) the profile of the test scores of the diagnostic measures for each child. This conceptualization was based on the official definition of a "learning disabled" child, as stated in the Education for All Handicapped Children Act (P.L. 94-142). Briefly, a learning disabled child is one with average or above average intelligence, but who is achieving only half as well as he or she is capable.. Since prekindergarten children are not yet in school, where achievement is measured, the scores on the diagnostic measures were considered an indicator of achievement potential. Specifically, the staff examined each profile of test scores for large discrepancies between the scores on different groups of tests. For example, if a child's score on the group of visual-input tests was two standard deviations above (or below) his score on the group of auditory-input tests, his profile was considered a "learning disability" profile. In this way, the classification of potential school learning problems was conceived as the combination of mental age (MA) and learning disability profile (LD). The staff classified each of the

children in the validation study as either: (1) average MA, no LD profile, (i.e., no potential problem), (2) average MA, with an LD profile, (i.e., the "classic" learning disabled child), (3) low MA, no LD profile (i.e., likely to do poorly in school but not due to a learning disability), and (4) low MA with an LD profile (likely to do poorly in school, due to multiple problems). Figures 2 through 5 depict test profiles which represent these four types of classifications. The tests used for the profiles are listed at the top of each graph. The first two at the right are visual input-receptive language tests, the next one is visual input-expressive language, the four tests next to that are auditory input-expressive language, and then one which is auditory input-motor response. The following five are visual input-fine motor response, the next three are math, and the last on the left is gross motor. The scores are all converted to z-scores on the graphs, to make direct comparison possible.

Of the 139 children in the final sample, 75 were classified as normal MA/no LD profile, (i.e., no problem), 18 were classified as normal MA/LD profile, 20 were classified as low MA/no LD profile, and 11 were classified as low MA/LD profile.\* Fifteen were not classified due to a lack of test data on those children.

Teacher Ratings. The ratings of the children by the teachers were compared to the classifications based on the diagnostic measures. For 80 of the children (65%), the teachers and the diagnostic staff agreed, with agreement on 47 (63%) of the children as not likely to have problems and agreement on 33 (67%) of the children as likely to have learning problems. In other words, the teachers were as adept at rating problem children as they were at rating non-problem children. The teachers rated 28 of the children as potential

\*These classifications were used for research purposes only. The information given to the teachers about the children was in terms of each child's "strengths" and "weaknesses."

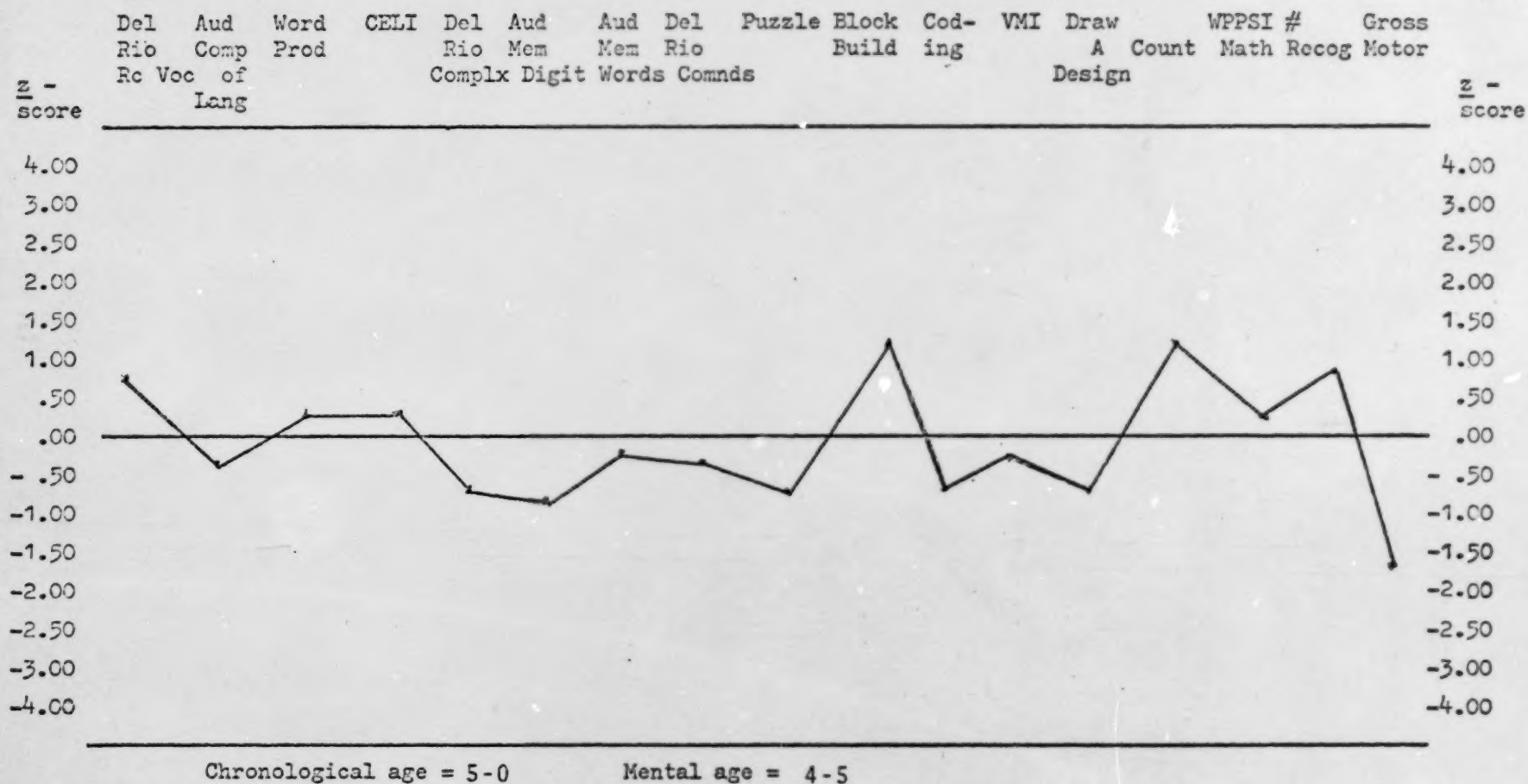


Figure 2. Profile of child with normal mental age and no learning disability profile.

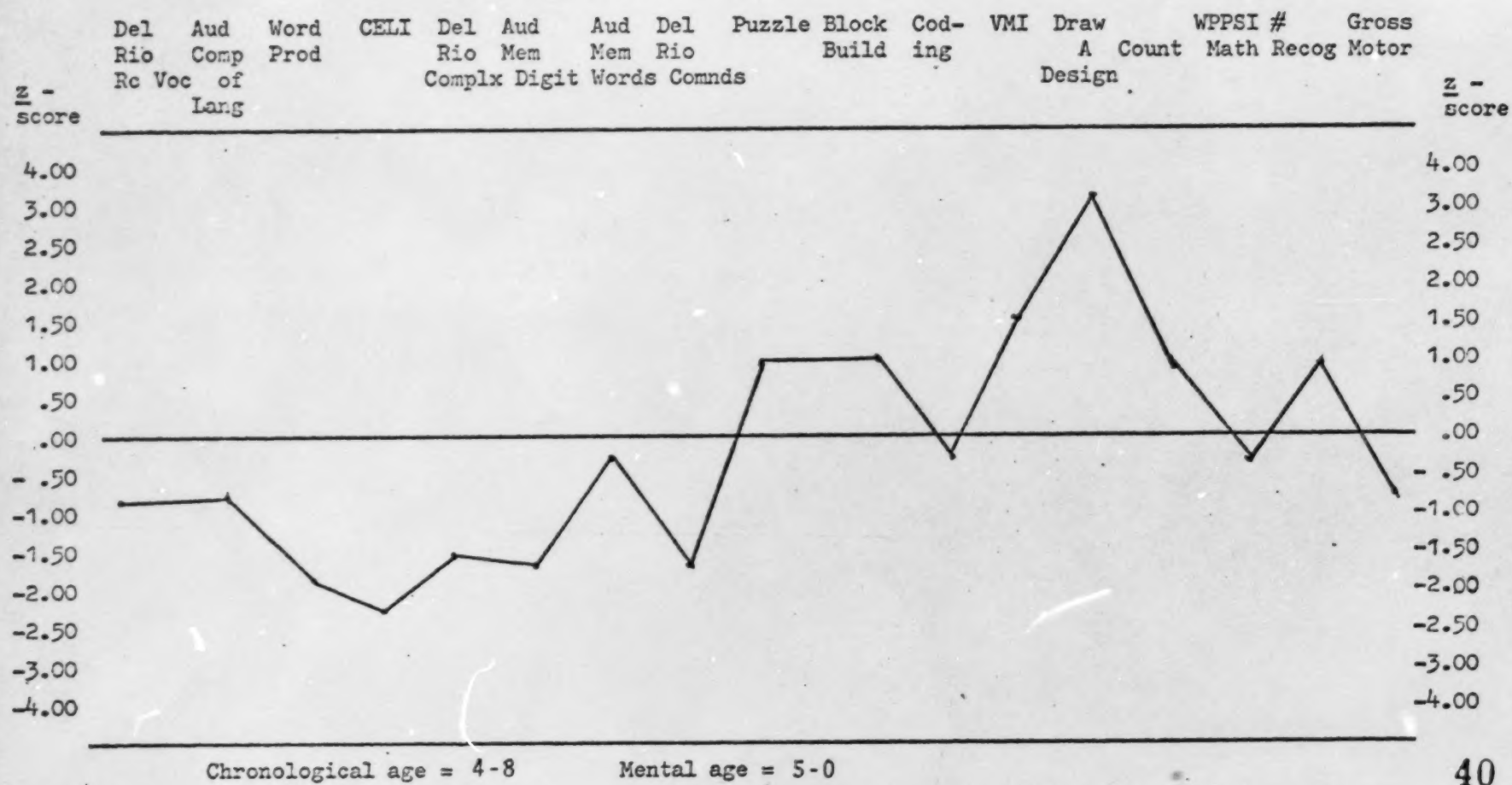


Figure 3. Profile of child with normal mental age and learning disability profile.

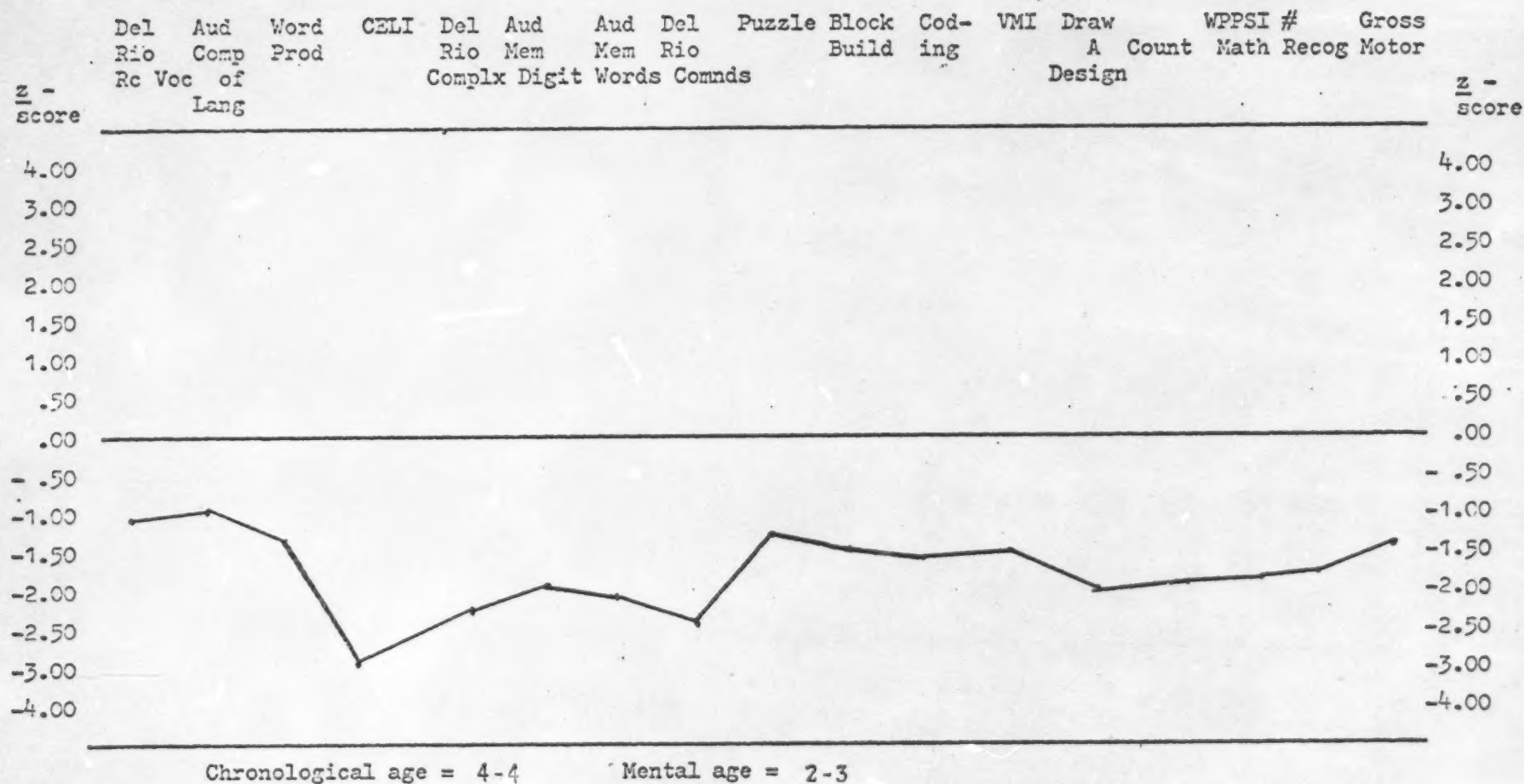


Figure 4. Profile of child with low mental age and no learning disability profile.

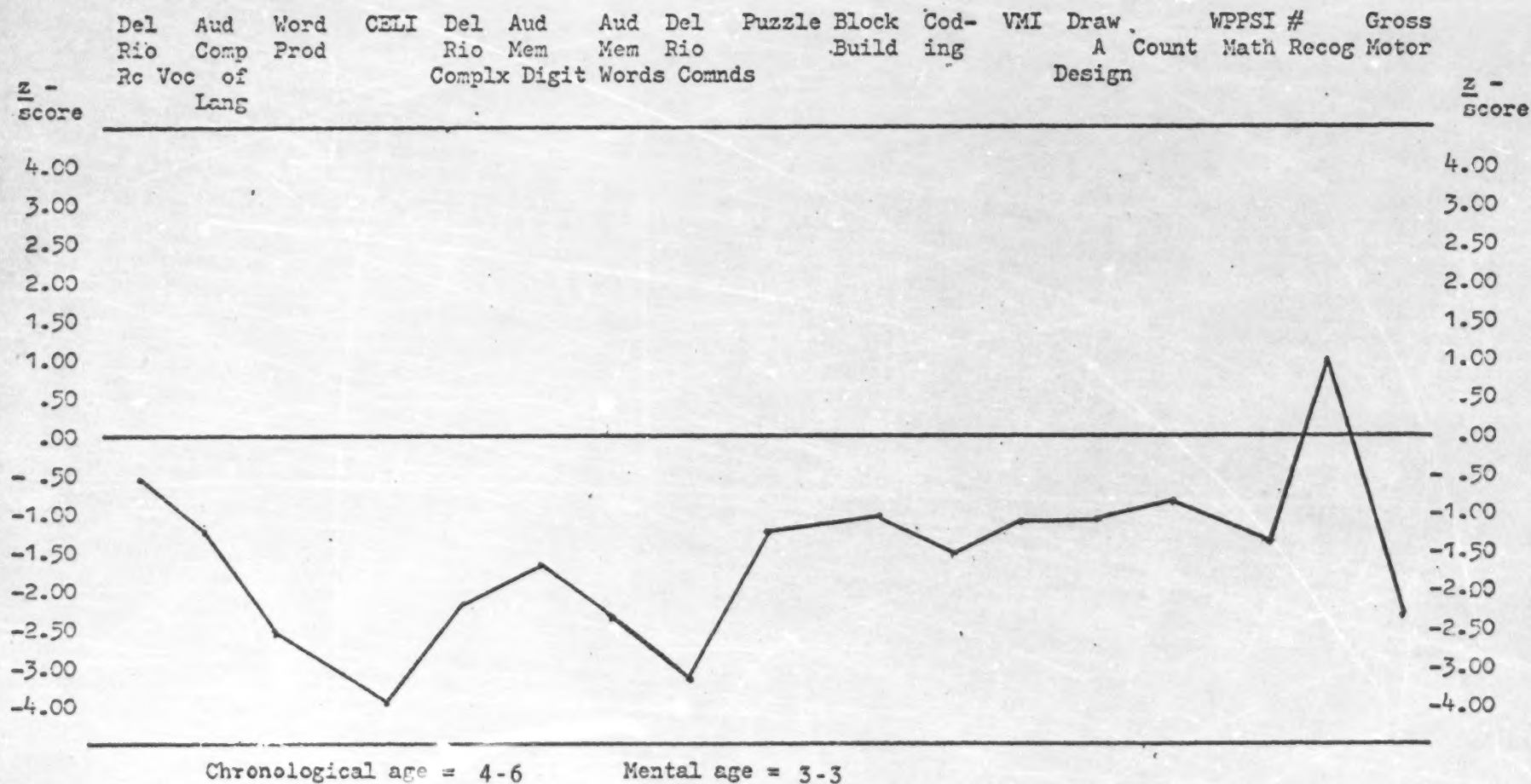


Figure 5. Profile of a child with low mental age and a learning disability profile.

problems that the diagnostic staff rated as no problem. Of these 28, 11 were rated as "auditory" problems by the teachers, indicating that the rating may have been based on the children not listening in class. However, when the children were on a one-to-one basis with the testers, they were quite capable of using the auditory instructions adequately. The teachers rated 16 of the children as not having problems that the diagnostic staff classified as potential problems. Of these 16, 12 were rated as "classic learning disabled" by the diagnostic staff. This discrepancy indicates that the "classic LD" child is the most difficult to be identified by teachers. This is not surprising considering these children have normal or above normal intelligence, and have not yet been placed in a situation where an information-processing deficit would be obvious.

Prediction Ability of Screening Device. The classifications of the 124 children rated by the diagnostic staff were used in a discriminant analysis with the variables of the screening device. The discriminant analysis program first developed the discriminant function which maximized the distance between the groups, and then the program used this function to group the children using the optimal screening device variables and weightings of the variables. These groupings were then compared to the original classifications based on the diagnostic testing. In other words, the goal of the analysis was to determine how well the 15-minute screening device could predict what 3 hours of diagnostic testing predicted.

Five such analyses were conducted, each comparing the group of no problems to (1) all three problem groups combined, (2) the classic LD group, (3) both the low MA and normal MA children with LD combined, (4) the low MA, no LD Group, and (5) the low MA and LD group. Tables 9 and 10 present the prediction results for these five comparisons. The first four comparisons resulted in

Table 9

Prediction Results of Analysis Discriminating "No Problem"  
Children From All Problems and from the  
Learning Disabled Children

## COMPARISON 1:

| <u>Actual Group</u>  | <u>No. of Cases</u> | <u>Predicted Group Membership</u> |                     |
|----------------------|---------------------|-----------------------------------|---------------------|
|                      |                     | <u>GP.</u> <u>0</u>               | <u>GP.</u> <u>1</u> |
| Group 0 all problems | 49.                 | 40.<br>81.6%                      | 9.<br>18.4%         |
| Group 1 no problems  | 75.                 | 8.<br>10.7%                       | 67.<br>89.3%        |

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 86.29%

## COMPARISON 2:

| <u>Actual Group</u>    | <u>No. of Cases</u> | <u>Predicted Group Membership</u> |                     |
|------------------------|---------------------|-----------------------------------|---------------------|
|                        |                     | <u>GP.</u> <u>0</u>               | <u>GP.</u> <u>1</u> |
| Group 0 LD (Normal MA) | 18.                 | 16.<br>88.9%                      | 2.<br>11.1%         |
| Group 1 no problems    | 75.                 | 6.<br>8.0%                        | 69.<br>92.0%        |

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 91.40%

## COMPARISON 3:

| <u>Actual Group</u>              | <u>No. of Cases</u> | <u>Predicted Group Membership</u> |                     |
|----------------------------------|---------------------|-----------------------------------|---------------------|
|                                  |                     | <u>GP.</u> <u>0</u>               | <u>GP.</u> <u>1</u> |
| Group 0 All LD (Normal & Low MA) | 29.                 | 23.<br>79.3%                      | 6.<br>20.7%         |
| Group 1 no problems              | 75.                 | 8.<br>10.7%                       | 67.<br>89.3%        |

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 86.54%

Table 10

Prediction Results of Analysis Discriminating "No Problem"  
Children From Children With Low Mental Age

## COMPARISON 1:

| <u>Actual Group</u>     | <u>No. of Cases</u> | <u>Predicted Group Membership</u> |                     |
|-------------------------|---------------------|-----------------------------------|---------------------|
|                         |                     | <u>GP.</u> <u>0</u>               | <u>GP.</u> <u>1</u> |
| Group 0 Low MA<br>No LD | 20.                 | 16.<br>80.0%                      | 4.<br>20.0%         |
| Group 1 no problems     | 75.                 | 5.<br>6.7%                        | 70.<br>93.3%        |

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 90.53%

## COMPARISON 2:

| <u>Actual Group</u>       | <u>No. of Cases</u> | <u>Predicted Group Membership</u> |                     |
|---------------------------|---------------------|-----------------------------------|---------------------|
|                           |                     | <u>GP.</u> <u>0</u>               | <u>GP.</u> <u>1</u> |
| Group 0 Low MA<br>With LD | 11.                 | 5.<br>45.5%                       | 6.<br>54.5%         |
| Group 1 no problems       | 75.                 | 1.<br>1.3%                        | 74.<br>98.7%        |

PERCENT OF "GROUPED" CASES CORRECTLY CLASSIFIED: 91.86%

comparatively high accuracy; the group of children classified as low MA with an LD profile were the most difficult for the screening device to identify as a single group. It is doubtful, however, that this group of children would ever need to be identified apart from the others.

The vehicle for the determination of these predictions was a discriminant function developed for each comparison. Each discriminant function consisted of the variables (i.e., items) of the screening device chosen as optimal for discrimination purposes and the coefficients (i.e., weightings) for each variable. In other words, the predictions were derived from a combination of the variables in a mathematical formula. The chosen variables in order of importance for the two most important comparisons are listed in Table 11.

The scores for each child on the target items were placed in the mathematical formula, thereby calculating one score per child. Each score was compared to the computer-selected optimal cut-off point (that score above which the child was predicted not to have a problem and below which the child was predicted to have a problem), resulting in the classification predictions. Of course, the cut-off point chosen by the program for grouping the children into one group or the other can be adjusted upward to insure that all problems will be identified (although also identifying more non-problem children) or adjusted down to insure that only problem children are identified (although more problem children will be missed). The decision to make such modifications would be based on the amount of funding available for the second level of testing and for the remediation program. That is, if there is a low level of funding, then it is reasonable to identify fewer problem children who are more likely to truly have learning problems, or the reverse if a higher level of funding were available.

Table 11

Screening Device Variables in Order of Importance  
Used in Two Discriminant Functions

Comparison 1 - No Problems compared to All Problems

Identifying "big" and "little"  
Building a "bridge"  
Sorting blocks by shape  
Gross motor tasks  
Articulation  
Demonstrating "1," "2," and "3"  
Drawing a line between parallel lines  
Puzzles  
Demonstrating "under" and "on"  
Recalling unrelated words  
Counting

Comparison 2 - No Problems compared to LD/Normal MA

Identifying "big" and "little"  
Building a "bridge"  
Articulation  
Recognizing function of objects in pictures  
Drawing a line between parallel lines  
Sorting blocks by shape  
Gross motor tasks  
Identifying parts of the body  
Identifying objects in pictures  
Recognizing action in pictures  
Puzzles  
Identifying colors  
Sex of child

Overall, the prediction results of the screening device are very encouraging. It should be noted that no discriminant function used more than half the variables of the screening device. This information indicates the possibility of modifying the screening device for greater efficiency and accuracy. The next step is to test out the discriminant function on a different sample of children: the sample of 840 children screened in the pilot study. Any one of the discriminant functions can be applied to the data of the pilot study in order to identify any one type of problem, or to identify all three types combined. A sample of the "problem" children as well as a sample of the "nonproblem" children can then be given the diagnostic assessments, to measure the accuracy of the screening device on a different sample of children than the one on which the discriminant function was developed.

#### Remediation

The step following the second validation of the screening device is the experimental testing of different intervention models, to determine which programs are most useful for remediating which types of problems. Based on programs with similar objectives (Karnes, 1973, Weikart, 1968), five different intervention models have been developed for comparison. The details of these models are presented in Table 12. In order to make direct comparison easier, all of the models are based on an enrollment of 40 children and/or 40 parents. Obviously the cost of each model can be increased or decreased by increasing or decreasing the number of children who will be served. However, the staff members agree that it would be in the best interest of the children to have no greater than a 5-1 pupil-teacher ratio in the classroom when the program is short and highly structured, as in Models 1, 2, and 5. Model 4 allows for more children per session because the sessions are longer. The parent component is considered as important a variable to be examined as the

Table 12

## FIVE INTERVENTION MODELS

|                                                  | CLASSROOM COMPONENT |                           |                     |                                    |                              |                        | PARENT COMPONENT |                           |                            |                           |                                  |
|--------------------------------------------------|---------------------|---------------------------|---------------------|------------------------------------|------------------------------|------------------------|------------------|---------------------------|----------------------------|---------------------------|----------------------------------|
|                                                  | # of children       | # of staff                | Child-Teacher Ratio | Amt. of time per session per child | # of days per week per child | Planning Time per week | # of Parents     | # of staff                | Parent Teacher Child Ratio | # of Parents seen per day | Total time per parent per week   |
| Model #1<br>(Training Center Children & Parents) | 40                  | 2 teachers<br>2 paraprof. | 5-1                 | 1½ hrs.                            | 4                            | 1 day                  | 40               | 2 teachers<br>1 paraprof. | 1-1-1                      | 10                        | 45 minutes                       |
| Model #2<br>(Training Center Children only)      | 40                  | 2 teachers<br>2 paraprof. | 5-1                 | 1½ hrs.                            | 4                            | 1 day                  |                  |                           |                            |                           |                                  |
| Model #3<br>(Training Center Parents only)       |                     |                           |                     |                                    |                              |                        | 40               | 2 teachers<br>2 paraprof. | 2-1-2                      | 12                        | 2 hours<br>(1 hour twice a week) |
| Model #4<br>(In School Children & Parents)       | 40                  | 1 teacher<br>2 paraprof.  | 10-1                | 2½ hrs.                            | 2                            | 1 day                  | 40               | 1 teacher<br>1 paraprof.  | 2-1-2                      | 10                        | 1 hour                           |
| Model #5<br>(Itinerant)                          | 40                  | 3 teachers                | 5-1                 | 1 hr.                              | 2                            | 1 day                  | 40               | 1 teacher                 | 2-1-2                      | 10                        | 45 minutes                       |

classroom component, since past research (Bronfenbrenner, 1975) indicates that parent education programs tend to result in greater long-term effects than do classroom programs alone.

The goal of the training in all models is the remediation of each child's particular deficit area (e.g., auditory-verbal, visual-motor), and not simply general enrichment. The in-school programs are to be run by special education teachers and trained paraprofessionals. The Parent-Child programs are to use teacher-therapists (i.e., individuals with a background in both counseling and early childhood) and trained paraprofessionals. The role of the teacher-therapist is to coordinate a parent "classroom" and "at home" program. The parent and teacher are to work together with the child in the classroom and develop materials and methods which could be implemented at home.

For research purposes, any combination of the models can be implemented in an experimental setting. In all cases, there must be a comparison group of children identified with similar deficits who are not in a special program. All the models with a classroom component, except the Itinerant Model, assume that transportation for the children will be provided through the school system during the experimental stage. This will insure that the sample of children in the program is not simply one whose parents can afford or care enough to provide transportation themselves.

## Conclusions

Summary of findings. The major findings of the study are:

- 1) The 15-minute screening device identified the "learning disabled" children (as defined by extensive diagnostic testing) with over 90% accuracy.
- 2) The ratings by the prekindergarten teachers were inadequate for identifying the "learning disabled" children.
- 3) Parents were not a reliable source of information about their children's development.

Implications. Now that we have discovered that a short screening device is capable of identifying children with potential problems fairly accurately, it is important to discover which of these types of problems are amenable to remediation. We can then incorporate the knowledge into the development of cost-effective programs which will be based on empirical evidence instead of mere intuition. We will be able to focus all our available resources on problems which we know with fair certainty are easily and validly identifiable and amenable to treatment. We will avoid the mistake of conducting early intervention programs which are ineffective, costly, and dangerous to the future of the mislabeled child.

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